

organic production

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PRODUCTION OF ORGANIC POTATOES

There is an increasing trend among consumers in the developed world to use "healthier foods". In many countries such as Europe, the USA and Japan, this has led to an increasing use of organically produced crops. This is mainly due to the perception that crops produced by "conventional" agricultural practices using artificial fertilisers, pesticides and herbicides are injurious to their health.

Organic agriculture, on the other hand, relies on natural products and processes to grow crops, while at the same time improving soil quality, controlling pests and promoting biodiversity. It uses the maintenance of sustainable ecosystems (people, plants, animals and soil) as the guiding principle for production. The term organic does not refer to the quality of the food at all, but rather the process by which that food is produced.

Organic farming is not new, many of the procedures used have been in existence for hundreds of

years, and were conventional agricultural practice until the advent of cheap inorganic fertilisers and pesticides. It is only comparatively recently (1970's) that certification procedures were developed to protect the original meaning of "organic" from being misused in the marketplace.

The idea of this article is not to give guidelines to producing organic potatoes, which would require a great deal more space than is available. It will, however, show the main areas where organic production differs from conventional production. If more information is required, please contact the author.

Differences between organic and conventional production

The major differences between organic and conventional production, apart from the certification requirement, are in the manner in which fertilisation, pest, disease and weed control are carried out. In conventional pro-

duction these processes are simple enough through the use of artificial fertilisers together with synthetic chemical herbicides, insecticides and fungicides. Unfortunately, these procedures are appreciably more difficult in the organic production process, and the major challenge for the successful production of organic potatoes lies in providing sufficient nutrients, the control of weeds, and preventing blight.

Certification

A third-party (state or private) evaluates the producer to see if they measure up to a set of predetermined organic standards. Those who do are then "certified" as organic producers and are able to use the certifying agencies' label on their produce to let buyers know that they are working according to agreed-upon organic guidelines. This ensures that consumers get what they are paying for when buying organic produce. South Africa does not yet have a

law governing organic production, and most certifying agencies use the EU regulations. The main certifying agencies in South Africa are BIO-ORG, ECO-CERT and SGS South Africa (Pty) Ltd. A copy of the regulations used can be obtained from these organisations. It is important that producers understand the standards used by the certifying agency, and that they keep in touch with their agency representative.

Most agencies put the producer through a three year in-conversion period. This means that although organic methods are being used to produce crops, the soil is still undergoing changes to full organic status. At the end of this period full organic status will be granted if the producer meets all of the requirements. For this reason no more than one-third of any operation should be converted in any year. In 2002 certification cost approximately R1200 per hectare.

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Crop rotation

A good crop rotation system forms the basis of any organic farming system. It is a system in which different crops are grown in succession and in a definite sequence on the same piece of land in such a way that no crop occupies the land for more than one year during the rotation system. There are a large number of suitable systems, but each system should be designed with the specific unit in mind.

Crop rotation systems are normally associated with pest (including weed and disease) management, but a good system will also help in improving soil structure and improving soil fertility. When planning a crop rotation sys-

tem make use of cropping records and consult with experienced organic farmers. Generally, the following guidelines will help in planning such a system:

- Balance fertility building with fertility exploiting crops
- Include a legume
- Vary crops with shallow and deep rooting systems
- Separate crops with similar pests and diseases
- Vary weed susceptible and weed suppressing crops
- Use green manure and cover crops
- Always try to increase the soil organic matter

Fertilisation

The ideal soil for potato production is a fertile, deep, well-drained loam,

high in organic matter. Nowhere is the slogan "feed the soil and it will feed the plants" as true as in organic farming. Artificial fertilisers are not permitted in an organic system and the producer must find other ways of providing the nutrients required by the plant. This can be addressed in a number of ways, including crop rotation, green manuring, animal manures, composting, and natural fertilisers (soil and foliar applied), but does require long-term planning. Foliar application of nutrients are used primarily to treat specific nutrient deficiencies, rather than for general fertilisation. Permitted substances for fertilisation are usually found in naturally occurring deposits (rock

phosphate, lime, gypsum, sulphur) or are derived from natural products (seaweed, manure, compost). Lists of permitted substances are given in addenda to the organic standards, and if a product is not on the permitted or prohibited list – call the agency representative and ask.

The over-supply of nutrients on an organic farm is highly unlikely as limited supplies of manures and composts are normally available. When planting potatoes it is normally a good idea to use relatively large amounts of composts and manures. Please note that only well-rotted (composted) manures and composts

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should be used. In order to avoid the loss of nutrients these materials should be applied to the soil shortly before ploughing and not left exposed on the surface for long periods of time. Nutrients from these sources are usually released slowly during the season and they help greatly to improve the soils biological, chemical and physical properties.

Cover crops, also called green manures, are grown specifically to be incorporated into the soil. They can help in reducing soil erosion and nutrient leaching, while improving the soil and helping with pest control. However, when choosing a cover crop it is important not to choose one that harbours potato pests (Buckwheat – *Rhizoctonia solani*). These crops should be suited to the soil, the crop rotation system being used, pest management practices and the needs of the potato crop.

Weed control

This is one of the most expensive of all farming operations, and this is particularly true in organic systems during the conversion period. The use of herbicides is prohibited by the organic standards, so alternative methods of control must be used. The first step in controlling weeds is to choose lands with limited weed problems, as this minimises the use of other options later on. Research has shown that mechanical weeding, when carried out carefully and at the correct time, can be just as efficient as chemical weed control.

In the potato crop the following procedures have proved to be very

successful:

- Flame weeding before emergence of the potato crop (expensive).
- Mechanical control using a spring tine weeder just before the tops meet. Once the plants meet between the rows the crop will suppress any weed growth. It is thus crucial that all weeds are well controlled prior to this. The use of cropping systems such as crop rotation, intercropping and a fallow period can also be used, but these are very difficult to justify only to control weeds. Solarization can also be used very successfully to control weeds. In this technique, the seedbed is completely prepared and then covered with plastic sheets for a period of approximately six weeks. The temperatures under the plastic rise to more than 65°C and kill weed seedlings and weed seeds in the surface soil. After this period the plastic sheets are removed and the crop planted with minimal disturbance of the soil. This can control up to 80% of weeds, but has limited depth of control.

Pest management

As there is no possibility of using chemicals to control insects or diseases, these need to be managed. The organic system regards pests as indicators of system problems, with pest outbreaks related to imbalances in the system. In these systems pest management relies on biological control measures, the use of insect predators and parasites, disease organisms, birds and bats. Most of these are to be found in conventional systems as well, but they are normally destroyed by the chemicals that are used to get

rid of the pests.

Sanitation is regarded as a very important component of pest management, but should only be treated as a temporary solution to the problem. Here it is particularly important to destroy infected plants, weedy habitats and sterilise implements. Together with this is the creation of habitats suitable for the protection of useful insects, the predators and parasitoids. Classes of permitted pesticides are minerals such as sulphur, botanicals such as neem, soap-based products (NOT detergent-based), pheromones and biopesticides such as *Bacillus thuringiensis* (Bt).

The major problem in potato production is that of late blight (*Phytophthora infestans*) control. This disease cannot be cured, and in an organic situation avoidance is definitely the best policy. The use of healthy seed material is imperative, as well as the use of forecasting and monitoring systems. There are also several cultural practices that can be used to assist with blight control. Several small fields can be planted rather than one large one, then blight will not have such a devastating effect. Scouting should take place regularly, and the moment blight infected plants are noticed they should be removed and destroyed, together with all neighbouring plants. If the tuber yield is already acceptable it is possible to remove all tops immediately and apply a permitted fungicide (copper formulations) to the remaining stalks. Harvest and market the crop promptly.

If the tuber yield is still low when the disease strikes apply the permitted fungicides as soon as the disease is diagnosed and monitor developments on a daily basis. The use of

compost teas (watery extracts of composts brewed with a microbial food source) has proved to be successful in trials, unfortunately they need to be applied around eleven times per week. It is important that an integrated approach be used to this disease rather than relying on any single method. Before selecting a fungicide make sure that it is permitted by your certifying agency.

Harvesting

The only difference between harvesting a conventional potato crop and an organic one comes when the tops need to be destroyed, as no chemical methods of desiccation are permitted for an organic crop. In this case only physical methods can be used such as flailing, pulling or flaming.

Economics

Potato prices vary considerably on the market, and the returns on organic potatoes can be influenced by this. Because of the intense competition on the market, and the fact that the labour demand by an organic crop is so high, organic potatoes are normally not profitable when sold through conventional marketing channels. Generally the yield of organically produced potatoes is lower than that of conventionally produced potatoes as well, and outgrades can be as much as 50% of the crop due to scab infection. A study carried out in America indicated that costs of potato production increased by 15% during the first year of conversion from conventional to organic production, while the yield decreased by 35%. Table 1 shows results of organic potato production in Germany and the

TABLE 1 Economics of organic and conventional potato production in Germany and the United Kingdom (from Bock et al., 2002)

	Germany			United Kingdom		
	Convent.	Organic	% Diff.	Convent.	Organic	% Diff.
Yields	41.9	25.1	59.9	42.5	25	58.8
Price	92	276	300	131.4	410.5	312.4
Gross Income	3855	6698	173.75	5584	10262	183.8
Variable costs	1580	1645	104.11	3446	3037	88.1
Organic farming subsidy	0	114		0	0	
Gross margin	2275	5166	227.08	2138	7225	337.93

UK from 1996 to 1999.

From Table 1 it can be seen that although the gross margin of organic potatoes is higher, yields are around 40% lower than conventionally produced potatoes, while

costs are between 4 and 28% higher. A great contributing factor to the improved margins of organically produced potatoes is the price, which is three times higher than that for conventional-

ly produced potatoes. At the same price an organic farmer would only make around 30% of what a conventional farmer would. It is thus obvious that organic potatoes do not pay as well as con-

ventional potatoes unless the crop can be sold for a premium. A similar situation exists in the UK.

Conclusion

Converting to organic farming is not something to be taken lightly and good long term planning is required. Monocropping is impossible in this system, which increases costs considerably. Pest and disease management can be problematic and there is no single recipe that will work. The system will only be economically viable if a premium is paid for the produce.